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Development of Ball and Roller Bearing Greases

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Presented before the 9th Annual Convention N. G. L. I.

The most crying need of the grease industry today is satisfactory standardized measuring devices which will accurately measure the relative lubricating value of greases. There are, no doubt, quite a few good testing devices being used by individual companies,but many of these are still in the home-made stage and are not, as yet, considered standard equipment. We hope that some of these tests will soon be brought to light and be made available to the industry. Some testing apparatus are being sold thru Chemical Equipment companies and are serving their purpose to very good advantage, but we have found it necessary to make home-made equipment for some of our tests and have been fortunate to borrow some from other laboratories through interchange of ideas. It is through meetings such as these that closer cooperation is accomplished by such exchange of ideas that will benefit the entire industry. I hope some day to hear papers read from this platform when the author will be able to talk in terms of test results that will be understood by all without first explaining the test procedure in detail.

A summary of properties of Ball & Roller Bearing Greases discussed in papers presented here in the past by lubrication authorities lists at least thirteen important characteristics which influence, to a more-or-less degree, the successful performance of those greases as lubricants. To review all of these characteristics in a single paper would consume more time than is usually allotted, so my discussion will be limited to the following six important properties of Ball & Roller Bearing Greases, namely:

1. Oxidation stability
2. Mechanical stability
3. Oil separation
4. Starting torque at low temperatures
5. Melting point
6. Texture

Oxidation stability is usually described as the ability to resist oxidation. When hydrocarbons and fatty acids in soaps oxidize, harmful acids and oxidation products are formed which have the undesirable ability to corrode metal. It is therefore very desirable to have greases that are as immune as possible to oxidation. This desire for greases which resist oxidation was increased when "Packed for Life" bearings and alloy cages were introduced, and it was found necessary to aid them in their struggle to resist oxidation. Such aid is given by the addition to the grease of minute quantities of chemicals usually referred to as "Oxidation Inhibitors." These inhibitors react differently with different oils and soaps, so in order to pick out the proper combination it is necessary to call in the Research Department.

We began the study of oxidation inhibitors in greases by first making a study of the effect of a long list of so-called inhibitors in many different combinations of blends of oils. To make these studies we devised our own test using the Indiana apparatus, but varying the test procedure as follows:

> The bath is brought to a temperature of 300°F. and 400 cc of the oils to be tested are placed in the chemically cleaned glass receptacles filling them slightly over half full. Eighteen feet of freshly polished 14 gauge copper wire wound into a helix 1½" in diameter is dropped into each receptacle and a ½" glass tube is introduced thru a slotted cork until the end just clears the bottom of the large tube. The assembly is placed in the bath and oxygen is introduced through the small tube at the rate of ten liters per hour. Samples are withdrawn at 8, 24, 32 and 48 hour intervals. Neutralization number, naphtha insolubles and viscosity increase are determined in routine tests. At the end of the test the copper wire is examined for surface appearance and deposition of lacquer or coke.

Mineral oils without oxidation inhibitors oxidize to destruction within a few hours in this test, but when properly inhibited they last well beyond the 48 hour test period. Fig. 1 shows the neutralization number increase of a representative oil with and without an inhibitor. After a satisfactory oil and inhibitor combination was developed it was then necessary to find a suitable fatty base, which, when cooked into a soap was compatible with both the oil and inhibitor. The Norma-Hoffmann apparatus, which was explained in detail here several years ago was used to make these tests. This apparatus is reliable and we believe it should give a fairly accurate and reliable indication regarding both the storage life and actual field performance.

Small amounts of catalysts such as copper alloy filings will, when mixed thoroughly with grease, accelerate the oxidation test from five to ten times faster than when no

catalyst is used. Fig. 2-Sample A shows a grease with a fairly satisfactory oxidation curve when no catalyst is used, but Sample B reveals that when copper lead filings are added, the grease oxidizes rapidly. Due to this acceleration, we adopted the use of a copper alloy catalyst which also gives a similarity to actual performance if the grease be called on to lubricate bearings equipped with copper alloy cages. In order to further speed up the tests a bath temperature of 210°F. was used on soda grease. After the test is completed free fatty acid or alkali and melting point are determined to note the change during the oxidation period. The fatty oils used in the soap stock have considerable effect on the oxidation stability of the grease, but the governing factor is the type of oil used. Fig. 3 shows the oxidation curve of three greases, each having the same fatty base and inhibitor but made with three different oils, Napthenic, Conventional Paraffin and Solvent Extracted Paraffin. The destruction of the Napthenic Oil grease was much more rapid than the greases made with Paraffin Oils. We succeeded later, however, in working out a blend of Napthenic and Paraffin Oils that could be satisfactorily inhibited when made into a grease. Different soap bases, however, may react differently as shown in Fig. 4 and 5. The line base grease broke quickly, probably either due to the moisture in the grease, or the soap was not compatible with the inhibitor. The inhibitor may be added to the kettle during the cooking operation or by means of suitable solvents after the grease has been cooled. Concentrated solutions of the inhibitor may be kept in stock and small amounts may be added to the grease by means of milling or mixing equipment.

Care and precision during the cooking operation cannot be emphasized too strongly. A slight change from basic to free acid in the grease or vice-versa may render a good inhibitor useless. Variation in moisture content also has a decided influence on the effectiveness of an inhibitor.

Fig. 6 shows two samples of the same grease, one worked strenuously to aerate as much as possible and the other had been treated in a vacuum to remove as much air as possible from the grease. The oxidation curve shows very little difference in the worked aerated grease which may approach the conditions in a bearing and one practically free from air such as a grease in the storage container.

Good mechanical stability of a grease may be described as the ability of the grease to retain its consistency after it has been subjected to mechanical working. A rapid idea of this quality in a grease may be determined by the ASTM grease worker and penetrometer. The worked penetration is taken at the usual 60 strokes of the worker and again at each additional 60 strokes up to 300 strokes. A curve can be drawn which visualizes the mechanical breakdown of the grease. Fig. 7 shows a good and bad breakdown of two greases.

The B. E. C. machine, also described here some time ago shows the ability of the grease to withstand rolling in ball bearings and, in addition, shows the ability to resist working thru the seal, aeration, and change in texture. The starting and running torques, which are also determined on this machine are more of a function of the viscosity of the oil used in the grease. The B. E. C. test is a good one but it is necessary to use an excess quantity of grease over normal requirements in order to have sufficient quantity to make proper analyses after the test.

The Shell Oil Company has developed an excellent test for determining the mechanical stability of greases and I understand the details of this test will be made public in the future.

The factors influencing mechanical stability are quantity and type of soap, fatty base, type of oil used and method of manufacture. The viscosity of the oil has little effect except where high pressures are encountered. It does not always hold true that high soap greases have better mechanical stability than low soap greases, for we have seen many cases of the reverse order; but as a general rule increasing the soap content up to an optimum point will help. It is usually necessary to mill greases having high soap content in order to reduce the consistency to the point where they can be easily applied.

The intricate problem of compatibility of different types and viscosity of oils with different fatty oils and soaps would take hours to discuss. However, most grease manufacturers have accumulated volumes of data on this subject, so to merely mention that the kind of oil or blend or oil used in a grease often means the difference between a successful and unsuccessful grease should be sufficient. The manufacturing technique of the cooking and cooling process opens up a huge field for future research. The grease research chemist does not need to be told that a slight change in manufacture often means the difference between a good and poor product.

Oil separation: The ability of a grease to resist oil separation is very essential to good lubrication. It must maintain its consistency and texture both in storage and in operation, so if the oil is not thoroughly incorporated into the grease it cannot maintain its uniformity. Elevated temperatures have a very influencing effect on oil separation. Grease which may be thoroughly uniform at room temperature may suddenly start to leak oil at higher temperatures, so, for this reason, most tests to determine oil separation are made at elevated temperatures. The Navy Test is a good rapid test to predict the oil separation while the grease is in the storage container but may be open to argument regarding its value as a test to show actual performance.

THIS TEST IS GIVEN AS FOLLOWS:

"Separation shall be determined by weighing approximately 10 gms. of grease into a tared perforated nickel filter cone; supporting the cone in a tared, 100 ml beaker and holding at 150°F. in a thermostatically controlled oven for 50 hrs. The increase in weight of the beaker, divided by the weight of the sample of grease, multiplied by 100 gives the separation in per cent by weight. The separation per cent in 50 hours should not exceed .1%".

Some companies test oil separation by merely cutting a groove across the top of the grease in the container and observation is made each day on the quantity of oil which leaks into the groove.

For tests on special greases which operate at exceptionally high temperature, one Ball Bearing company raises the temperature of its test to 275°F. and requires this temperature to be held for 200 hrs. Oil separation and mechanical stability seem to run hand-in-hand. Factors influencing one seem to influence the other. For instance, the increase of a small amount of soap content sometimes eliminates oil separation just as it increases mechanical stability. The kind of fatty oil used to make the soap also has its influence. We had trouble with oil separation with one type of our Ball Bearing Grease but by increasing the per cent of glycerides and reducing the fatty acids the oil separation was eliminated. A change in cooking temperature or cooling rate may change the entire performance of a grease. These are all matters of definite importance that is necessary for each grease manufacturer to work out with the raw material which he has available.

The results of one test we ran led us to believe that an aerated grease in service does not leak oil as rapidly as one in storage. Oil separation tests were run on two greases, one that had been worked to aerate it as much as possible and the other had been treated in a vacuum to remove the air. We observed that the one which had been vacuum treated had a larger per cent of oil leakage than the other. It seems therefore, reasonable to say that greases which are in constant use in bearings are not as susceptible to oil separation as one in storage. Then too, the constant working of the grease keeps the oil worked back into the soap base.

Machines often lay idle for long periods of time and one may find it necessary to start up on some cold morning at a moment's notice. Naturally a frozen bearing or

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1942 Motor Oil and Gear Lubricant Recommendations Available

To enable service station operators to service all 1942 passenger cars, trucks and tractors correctly with the right grade of motor oil and gear lubricant, The Chek-Chart Corporation, 624 S. Michigan Avenue, Chicago, has just published the new 1942 CHEK-CHART Wall Chart.

These new charts show capacities of crankcase, transmission, differential, cooling system and gas tank, together with motor oil and gear lubricant recommendations for all makes and models of passenger cars; also motor oil and gear lubricant recommendations for more than 95% of the trucks, tractors, and Diesel engines in use.

All the information contained on these charts has been attractively printed in 2 colors (red and blue) and covers all models produced for 1938-1942, inclusive.

In the present emergency, when everyone is preaching better and more frequent service to prolong car life and improve performance, these charts will be more useful to petroleum retailers than ever before. To make them easier to use, Chek-Chart has restyled the body, adding "breathers" or blank spaces every five lines. A new method of make, year and model listing also is used, which facilitates determining the exact recommendations.

*Mounting and Dismounting Tires on Safety Wheels**

Since September, 1940, all wheels on Chrysler, DeSoto, Dodge and Plymouth passenger cars have been equipped with the Chrysler Safety Rim.

The Safety Rim differs from regular rims by having a hump or raised portion formed on the inside edge of the bead ledge over which the tire bead must be forced to obtain its proper seating on the rim.

The purpose of this hump on the bead ledge of the rim is to hold the tire beads seated on the rim if a tire goes flat, thereby preventing the beads from dropping into the well of the rim, reducing the tendency toward folding or buckling of the tire and subsequent side pull or drag on the wheel.

The hump feature on the bead ledges of the Safety Rim requires some changes in the technique of tire mounting or dismounting to insure proper seating of the beads on the rim and prevent pinching or buckling of the inner tube, or unnecessary damage to tires.

DISMOUNTING TIRES

(A) When tires are to be removed from Safety Rims the wheel should be removed from the car and placed flat on the ground or floor with outside of the wheel turned up.

(B) Completely deflate tire — remove valve core if necessary. NOTE: Because the hump on the bead ledge holds the tire bead firmly on the rim, a special tool is required for dislodging the beads. Chrysler supplies a tool for this purpose in the tool kit of all cars with full operating instructions attached.

Since the introduction of this wheel, many types of tire removing tools have been introduced on the market. One such tool is manufactured by the Miller Tool Co., Detroit, Mich.

(C) Before starting removal of the tire, wet the tire sidewall at the point where removal is to be started with a mild soap and water solution or plain water. Insert the tapered tip of the tool carefully between the rim flange and the tire bead and pull it into place with the cam toggle hooked over the rim flange.

(D) Apply lever bar over the center stud and pry a section of bead loose from bead ledge slowly.

(Continued on page 7, col. 2)

BALL & ROLLER BEARING GREASES

(Continued from page 2)

two would not be very desirable. For that reason tests to evaluate the starting torque of greases at low temperatures are very necessary.

The December 1940 issue of *"Lubrication"* published by the Texas Company describes quite a few of the machines now being used for this purpose. Our apparatus is shown in Fig. 8. We find it very convenient, for four tests can be run simultaneously making it very desirable for check tests. Our procedure for this test is patterned after the Navy Test which is as follows:

"A clean dry No. 204 Ball Bearing such as is used in the B.E.C. Machine is weighed to 0.1 gram. The bearing is packed with an excess of the grease to be tested and run in at 3600 RPM for 30 seconds, then the excess is removed until .6 to .7 gms. remains in the bearings.

"The bearing is then fixed on the shaft of the cold test machine unit and placed in the air bath of the machine. A similar bearing without grease but containing a few drops of 100 Pale Oil constitutes the 'hot bearing' at the opposite end of the shaft. At the outside end of the shaft a pulley with a 2.22 cm. radius carries a string on which weights, and thus torque, may be applied when desired.

"When each unit of the apparatus is in place, the chilling of the solvent is started by the addition of small lumps of dry ice to naptha which is used as the cooling medium. A thermometer in the naptha and another in the air bath gives the operator sufficient control of the chilling process. Chilling is carried out at such a rate that two hours are required to cool the bearing from room temperature to minus 40 degrees.

"The bearing is then maintained at minus 40° for one hour—giving a total of three hours chilling time.

"The actual testing of the bearing is accomplished by carefully adding sufficient increments of torque to break loose the bearing and to observe the time in seconds required for the first complete revolution of the shaft."

The viscosity of the oil as well as the kind of oil used are the dominating factors influencing the results of this test. Fig. 9 shows that the per cent of soap and the penetration of the grease had little effect on the starting torque. Greases made with paraffin oils gave very inconsistent results, fig. 10, but those made in which a large percentage of Gulf Coastal Oils were used blended with Paraffin Neutrals gave definite consistent results. Low pour depressants had little effect on the results of the test.

The Melting Point or Dropping Point of grease and its meaning has long been a point of discussion. This paper does not propose to discuss this point but rather to point out factors which influence the melting point if high melting point should be desired.

The temperature to which the cooking operation is carried is probably the dominating influence of this property of grease. Titre of the fatty oils also is important but not as much so as has been emphasized. It is true the kind of oils used in the grease also play a part but this may be due to the fact that low viscosity oils cannot be carried to high cooking temperature due to danger of fires unless special kettles be used. To obtain melting points in excess of 400° F. the cooking temperature should be carried beyond 500° F. and high flash paraffin oils should be used. We have not been very successful in raising the melting point much in excess of 400° F. when Gulf Coastal Oils are used. The percent of soap is important within certain limits. However, beyond certain quantities the influence of excess soap on the melting point is negligible.

Texture of grease: This property is somewhat difficult to define but the grease manufacturer is familiar with such terms "buttery" — "Non-fibrous", "Short Fibre" and "Long Fibre" which are self-explanatory.

Lime and Aluminum Soap greases always give smooth or buttery texture greases, but soda soap greases can be made from smooth texture to almost any length of fibre desired. Almost every ingredient used in the manufacture of grease has an influence on the texture of soda soap greases. Factors influencing the smooth texture or non-fibrous character of soda greases are: High titre Fatty Acids used in the soap, low moisture content of the grease, low viscosity oils, high cooking temperature and rapid rate of cooling. Conversely those tending towards the fibrous structure, are low titre glycerides in the soap, high moisture content, low cooking temperatures, high viscosity oils, and slow rate cooling.

Milling operations also are necessary at times to obtain proper texture. This is, as a rule, a desirable operation, for it works the grease thoroughly when cold giving the entire batch more uniformity.

It is necessary for the grease manufacturer to make additional tests on his greases year after year, thus making it more imperative to enlarge and expand laboratory facilities. Grease cooking equipment must also be studied and standardized to yield more uniform products. Faster tests must be devised to facilitate shipments without delays. Manufacturers who are planning 5 to 10 years in the future already have a staff of chemists working out details for the manufacturer of new and better greases. Grease manufacturing is rapidly emerging into a scientific art which must be controlled by a staff of technicians. New developments are being made each day, so in order to keep abreast or ahead of these developments, it is necessary to insure future business stability with an alert, efficient research staff.

FIG. 1

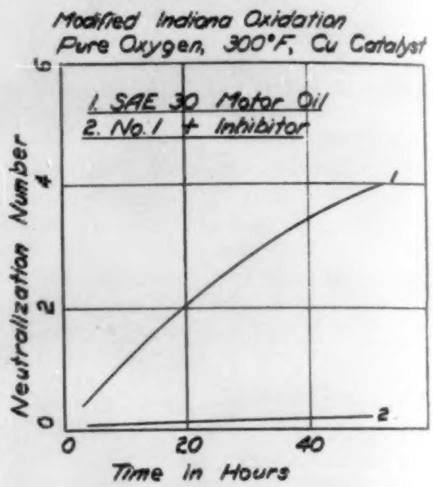
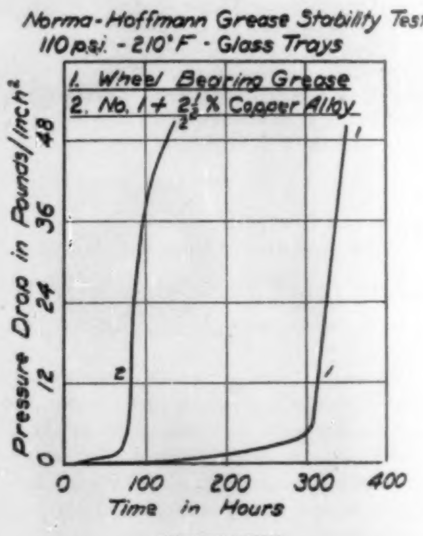


FIG. 2



Windshield Wipers and Their Service

There is a very interesting article in the December issue of *Motor,* page 44, covering a subject that, as a rule, receives very little attention.

The general impression is that the mechanism which operates windshield wipers is good for the life of the car with the exception of renewing the wiper blade. A careful reading of this article brings out the fact that periodic servicing of these units will promote longer life of the mechanical parts, as well as provide clear vision under unusual weather conditions.

FIG. 3

Norma-Hoffmann Grease Oxidation
$2\frac{1}{2}$% Added Copper Alloy, 110 p.s.i., 210°F

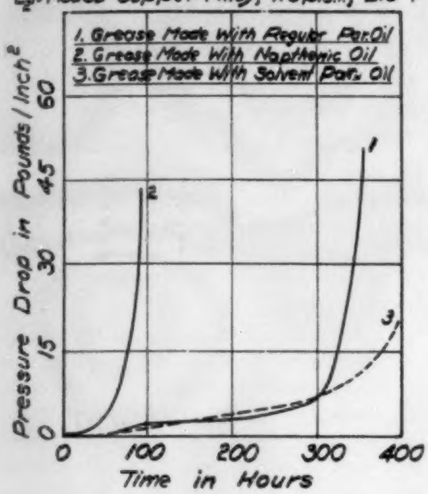


FIG. 4

Norma-Hoffmann Grease Oxidation
$2\frac{1}{2}$% Added Copper Alloy, 110 p.s.i., 150°F

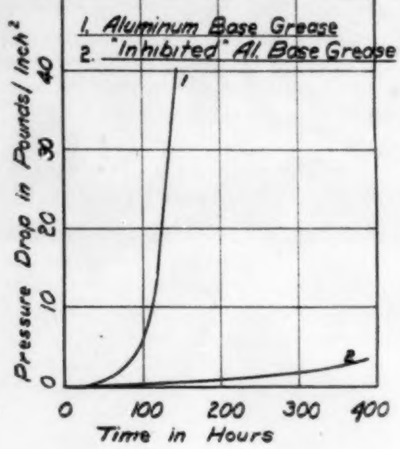


FIG. 5

Norma-Hoffmann Grease Oxidation
$2\frac{1}{2}$% Added Copper Alloy, 110 p.s.i., 150°F

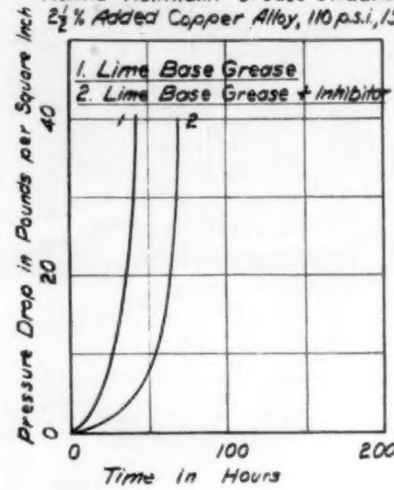


FIG. 6

Norma-Hoffmann Grease Oxidation
$2\frac{1}{2}$% Added Copper Alloy, 110 p.s.i., 150°F

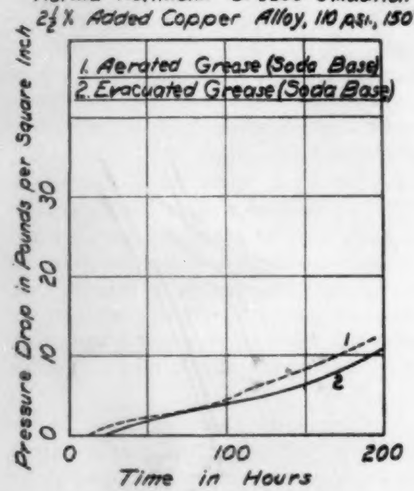


FIG. 7

Mechanical Breakdown in
ASTM Grease Worker

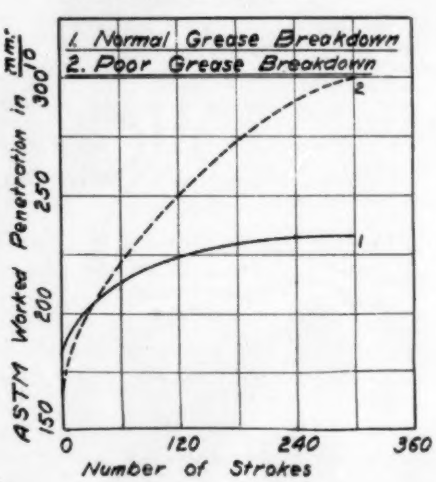


FIG. 8

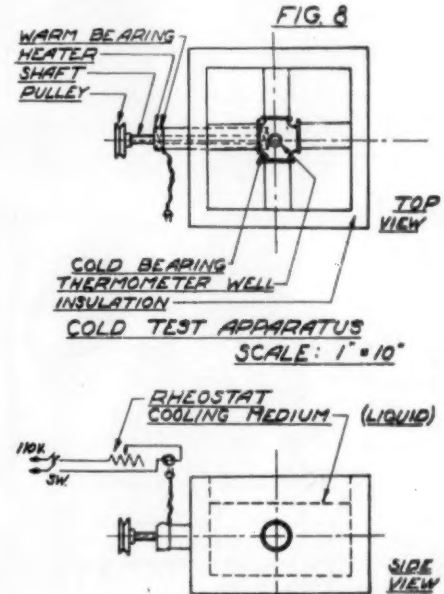


FIG. 9

Starting Torque of Grease at
-40°F, Type 204 Bearing

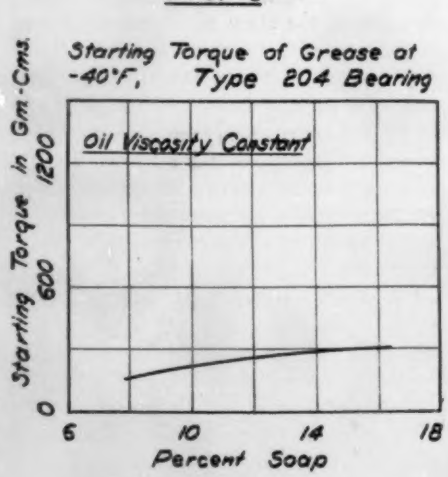


FIG. 10

Starting Torque of Duplicate
Samples of Grease at -40°F,
Type 204 Bearing

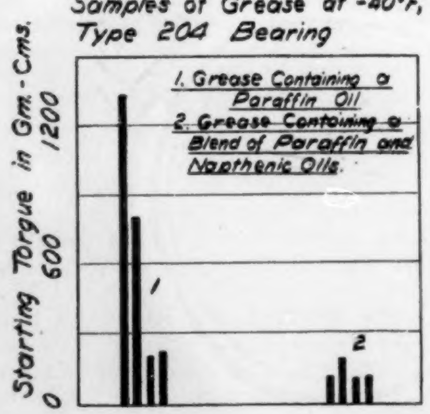
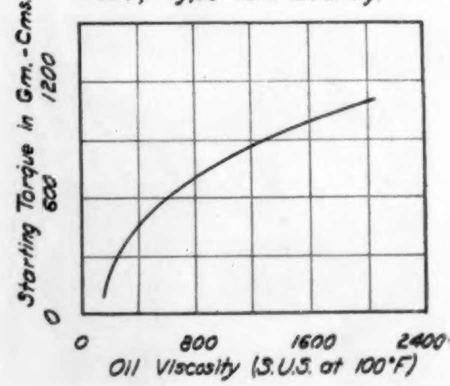


FIG. 11

Starting Torque of Grease at
-40°F, Type 204 Bearing.



Car Manufacturers Recommendations*

Studebaker Postpones Turbo-Matic

Studebaker has just advised that due to the acuteness of the materials situation the management has decided to postpone for an indefinite period the manufacture of cars equipped with Turbo-Matic drive.

Lighter Motor Oils for Studebaker When Transmission Overdrive Is Used

Studebaker Motor Oil recommendations for 1942 present a new situation for the service station. In the first place, all motor oil recommendations for temperatures over 90° were previously SAE 40 for all years. This recommendation is changed for 1942 to SAE 30 on all 1942 cars with conventional transmission and to SAE 20 on cars equipped with Transmission Overdrive.

For temperatures above 32° SAE 30 is recommended for cars with conventional transmission or SAE 20 for cars with Transmission Overdrive. For temperatures above 10° SAE 20 is recommended for cars with conventional transmissions and SAE 10 for cars with Transmission Overdrive.

This same difference in recommendations may also be applied to cars of previous years but it is not required.

Draining the Ford 6 Cylinder Engine Crankcase

The gear type oil pump used on the Ford six cylinder engine is an integral part of the front main bearing cap and is driven by a gear which meshes with the crankshaft timing gear. The amount of pressure is controlled by a regulator valve at the front end of the main oil line.

The oil tube within the crankcase pan delivers oil to the screen. An inverted cup is integral with the oil tube. An oil screen is likewise integral with the drain plug and is automatically removed when the drain plug is removed.

In case the oil screen should entirely fill up with sediment, there is a valve in the top of the screen unit which permits the oil to automatically by-pass around the outside of the screen and down into the sump for normal recirculation of the oil. This insures a constant supply of oil in the event the screen becomes clogged.

The crankcase oil drain plug is necessarily larger than the usual plugs as the screen, being a part of the plug, is removed through the plug hole (approximately 2¾ in. in diameter), when the plug is removed. The bottom of the plug is provided with a 1 in. square boss over which a wrench fits for unscrewing the plug. Care should be taken not to damage the threads.

Each time the crankcase is drained, all sediment should be removed from the screen by washing in kerosine or gasoline.

Motoring Public Becomes Lubrication-Conscious

Hit-or-miss lubrication is definitely out of the picture for aggressive automotive service dealers who expect to survive the grave situation confronting them in 1942.

Car owners are more conscious of the necessity for regular lubrication than ever before because:

1. For more than two years the American Petroleum Institute has preached the gospel of correct lubrication up and down the country — in the great cities — at the country cross roads. The story of "Lubricate for Safety Every 1,000 Miles" has been told by motion pictures, sound slide films, printed matter and speeches until it has become indelibly impressed upon the minds of millions of motorists.

2. Car factories, sensing reduced production and consequently fewer cars to sell —plus the necessity of making cars last longer—have been conducting service schools for dealers on the importance of SERVICE, emphasizing tune-up, fuel economy and lubrication.

3. The U. S. Army, recognizing the absolute necessity of periodic and correct lubrication, is now providing for Ordnance equipment a complete lubrication system of charts, bulletins, manuals, training programs, etc., to assure that every piece of equipment be in top-notch condition right up to the minute that it might be called into action.

4. Government agencies have warned the public that correct and regular lubrication is imperative to maintain automotive equipment and thus help conserve vital materials for defense necessities.

5. For several years Collier's magazine has carried the story of Preventive Service to millions of car owners, stressing lubrication as one of the key services in economical, safe driving.

6. Oil companies, car manufacturers, accessories distributors and all other automotive agencies are carrying on relentless campaigns to make motorists ever mindful of the necessity of regular service.

Now that car owners face the necessity of preventive maintenance and have come to the realization that regular servicing pays big dividends, every dealer has the opportunity to obtain more business than ever before. Lubrication will be one of the easiest sources of revenue for those dealers who

are well trained, properly equipped and adequately stocked with lubricants, and who aggressively solicit this business.

Removing the Battery on 1942 De Soto Models

At first glance it appears that the battery can not be removed on 1942 De Soto models without disconnecting the headlight control rod. This rod should not be disconnected as it is accurately adjusted to regulate the headlight.

Instructions which will permit removal of battery without dropping headlight control rod are as follows:

1. Raise the hood.
2. Remove battery cables.
3. Remove the two nuts on battery hold-down clamps and the bolts will then drop down out of the way.
4. Lift battery up about 1 in. and slide toward rear of car. The battery can then be lifted up and out of the car between the headlight control rod and fender.

"Gerotor" Type Lubricating Oil Pump

The lubricating oil pump of the "gerotor" type is a positive displacement pump making use of the internal gear principal for pumping fluid.

However, the pumping members differ from conventional gears by the small number of teeth used. This makes possible a gear set having sliding and rolling contact on one side and virtual sliding contact on the opposite side to form oil tight cavities to carry oil to the delivery side of the pump.

The rotors for this pump are composed of the outer and inner, the inner being a generated form from the outer. The outer rotor lobes are 5 circular arcs equally spaced. The inner rotor form is generated from the outer by revolving it eccentrically to the outer meanwhile turning it 1/5 of a revolution for each revolution of the inner rotor axis about the outer rotor axis. This generates a four-toothed form which is the inner rotor. Assembled, the inner rotor is turned by the drive shaft. It, in turn, rotates the outer rotor to which it is eccentric. Because of the speed differential of 4 to 5, cavities are formed which increase in size while on one side of the line of centers of the two rotors and decrease in size on the other. While these cavities are increasing in size they communicate with the inlet port and while decreasing, with the outlet port. These ports are crescent-shaped reliefs in the bottom of the housing connecting with cored holes to oil passages in the engine block.

Mounting and Dismounting Tires on Saftey Wheels

(Continued from page 3, col. 2)

(E) After a small section of the tire bead has been loosened, the balance of the bead may be loosened by walking off with the heels.

(F) Turn tire over and repeat the same operations for loosening the inside bead.

(G) After both beads have been loosened the tire can be removed from the rim with conventional tire tools and methods. Always be sure that the tire beads are set into the rim well at the point directly opposite from where the first section of bead is to be slipped over the rim flange.

No Machining Necessary

One of the big advantages of the "gerotor" type of lubricating oil pumps is that the rotors are made inexpensively from powdered metal. A combination of sponge iron and copper powders are used in a formula developed by Chrysler Corporation engineers. This composition is known as Super-Oilite and has exceedingly great strength. Its chief advantage, however, is that rotors can be manufactured from Super-Oilite by the die-forming method without the necessity of machining the finished product, and this results in considerable savings.

Rotors are first dieformed to the desired shape. This forming, or briquetting, is performed under intense pressure. Next the rotors are heat-treated for strength. Then they are brought to the proper dimensions and tolerances by male and female sizing dies. Inner rotor ends are finished by grinding and outer by coining. In this way normal machining operations are done by an inexpensive method.

One advantage to be gained by the use of the "gerotor" type pump over the gear type is the fact that a more efficient and quieter pump can be made at less expense. The result is larger oil flow to bearings at idle speeds where gear pump efficiency is very low for a given pressure.

MOUNTING TIRES

(A) Before placing tube in the tire be sure to inflate it until rounded out smoothly, but not stretched.

(B) With the tube inside the tire, thoroughly paint both tire beads with a mild soap and water solution. (Not grease.) NOTE: The soap-water solution should be used on all new or used tires mounted on Safety Rims.

(C) With these precautions the tire can be placed onto the rims by using the customary tools and methods.

(D) After tire is on the rim, lift the tire into a centered position on the rim, then place tire and rim flat on the floor for inflation. Do not inflate the tire in a standing position or with the wheel on the car.

(E) When inflating the tire two popping sounds will be heard as beads snap over the hump on the rim ledge.

(F) Check the pressure after beads have snapped into place; if pressure is less than 20 lbs. the inflation to operating pressure may be completed, if more than 20 lbs. are required for seating the beads it is a signal that the tube may be pinched under the tire bead.

(G) In such cases, the tire should be deflated and the beads loosened from the rim ledges, then re-inflated.

Lubricate for Safety Every 1,000 Miles to Help Reduce Traffic Deaths in 1942

Every Automotive Service Employee Is Obligated to Protect Motorists Through Preventive Maintenance

With traffic fatalities for 1941 about 16% higher than for 1940, and with a new year just ahead, the significant part that lubrication can play in the safety of American motorists is forcefully brought to the foreground.

According to the National Safety Council, traffic deaths for the first 10 months of 1941 totaled 31,620 — a 16% increase over the 27,210 toll for the same period last year. Figures for November and December are not yet available, but it was hoped that the emergency effort of 130 organizations cooperating with the Council in the past several months will result in a more favorable picture for the entire year.

Some Accidents Blamed on Lack of Lubrication

While the exact number of fatalities actually caused as a result of the lack of lubrication, or the improper application of lubricants, is not known, it is certain that some of the deaths—and thousands of serious accidents—could have been averted through vigilant inspection and regular lubrication of automobiles.

Furthermore, it is logical to expect that with automobiles being driven longer and subjected to more severe service, as the result of defense requirements, more and more accidents will result if cars and trucks are not properly lubricated.

It is, therefore, up to car and truck owners and operators to accept the responsibility of maintaining their vehicles in such condition that accidents cannot be attributed to lack of lubrication or other accident-prevention services.

Likewise, it is the obligation of every person operating an automotive service outlet—and every person employed in such an outlet—to inspect every vehicle at every opportunity and call the owner's attention to the need of lubrication or any other service that will help save the lives of American men, women and children in 1942.

Nation's Welfare at Stake

Accidents cause a drain on the Nation's manpower, which is vitally needed in the present emergency. Accidents rob men from hours of work, cut down the Nation's productive capacity—slacken the speed of our national defense. Accidents cost money, and bring unhappiness, too. The efficiency and welfare of a Nation are at stake—and they are too precious to lose through overlooking obligations which may seem so slight, but which, when added together, become so momentous.

The slogan of the Oil Industry to "Lubricate for Safety Every 1,000 Miles" becomes of greater importance. It is not only the signal for owners to have their vehicles properly lubricated every 1,000 miles, including the changing of oil, but it also becomes the sign for complete car inspection in the interest of safety. There is no better opportunity for a complete "Safety Inspection" of an automobile than when it is in the lubrication department. There it can easily be subjected to minute checking from bumper to bumper, and from tire tread to roof. And from the lubrication lift, the car can then be moved along for other specific inspections and the necessary adjustments, repairs and replacements as may be necessary to make it 100% safe for highway operation.

Lubrication, Safety Key

"Lubricate for Safety Every 1,000 Miles" is a good slogan to preach, because in its acceptance and application lies the key to a partial reduction in the tremendous unwarranted toll of life taken by the American automobile annually.

LUBRICATE FOR SAFETY EVERY 1000 MILES